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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/696,955	10/27/2000	Kazuyoshi Tamura	107703	3185

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EXAMINER

ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 04/17/2003

15

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/696,955

Applicant(s)

TAMURA ET AL.

Examiner

Matthew A. Anderson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3 and 5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3 and 5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 December 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1,3,5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ke et al. (US 6,284,093 B1) in view of Wolf et al. (Vol. 1 pp. 8, 23-27, 32-33, 59, 1986) and Tamatsuka et al. (US 6,299,982 B1).

Ke et al. discloses a non-dielectric ring which surrounds a workpiece wafer in a plasma semiconductor processing chamber. The ring is disclosed as consisting of Si of the single crystal variety in col. 6 lines 31-38. In col. 14 lines 66+ and col. 15 lines 1-10 the cylindrically symmetrical nature of the ring with respect to the wafer axis is disclosed.

Ke et al. does not disclose the oxygen or nitrogen concentration in the ring or the method of forming the ring.

Wolf et al. discloses known single crystal Si processing methods. Cz silicon was shown on page 8 to be well known. On page 23 –25 disclose methods of forming wafers. Etching of the surface to remove contamination and damage from metal working is also disclosed. Etching of On page 32 is disclosed the incorporation of

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oxygen and nitrogen into Cz silicon to increase the warpage resistance of the Si. This warpage resistance would be of great value in a batch processing chamber such as that described by Ke et al. In pages 531-532, acidic and alkaline etchants are described including aqueous mixtures of HNO₃, HF, Acetic Acid (CH₃COOH) and KOH /isopropyl alcohol. Water is described as a common diluent for etchants. On page 59, in the first paragraph, it is related that interstitial oxygen forms oxygen precipitates in Cz-Si which contribute to "the basis for intrinsic gettering"

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine Ke et al. and Wolf et al. because Ke et al. discloses Si mono-crystalline focus rings and Wolf et al. discloses known ways of working with and improving the warpage resistance of items formed from such Si.

The combination does not specify a ring with certain atomic concentrations of oxygen or nitrogen.

Tamatsuka et al. discloses Si wafers made from a Cz Si ingot which has nitrogen concentration of 1×10^{10} atoms/cm³ to 5×10^{15} atoms/cm³ and a oxygen concentration of 1×10^{18} atoms/cm³.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the Si of Tamatsuka with the previous combination because Wolf et al. discloses the superior warpage resistance of Si doped with oxygen and nitrogen.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to form a monocrystalline Si focus ring with a nitrogen concentration

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of 5×10^{13} atoms/cm³ to 5×10^{15} atoms/cm³ and a oxygen concentration of 5×10^{17} atoms/cm³ to 1.5×10^{18} atoms/cm³ because Si rings were known, such doping concentration of N and O was known for Si, and it was known that N and O increased the warpage resistance of Si. The intrinsic gettering property of oxygen in Si was also obvious to those of ordinary skill in the art as described by Wolf et al on page 59.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to etch the surface of the focus ring with either acidic or alkaline etchants because etching the surface of Si to remove processing damage and contamination was known to Wolf et al.

As far as the process for the production of the focus ring, it would have been obvious to one of ordinary skill in the art at the time of the present invention to form a ring from Cz monocrystalline Si because Ke et al. discloses such a shape, Wolf et al. discloses metalworking of Si, Tamatsuka et al. discloses Si with such doping concentrations and one of ordinary skill in the art would have been able to bore a hole thus producing a ring as in Ke et al.

Claim Rejections - 35 USC § 112

2. Claims 1,5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "increase" is not definite in that is unclear on what basis the improvement would be judged.

Response to Arguments

3. Applicant's arguments filed 3/19/2003 have been fully considered but they are not persuasive.

The applicant's argument that Ke does not contain every aspect of the applicant's claim is noted but is not convincing. The examiner's rejection is based on a combination and is set forth with a motivation for that combination. Ke uses a pure Si focus ring. Wolf et al. discloses known methods of producing Si in shapes having a round outer perimeter (i.e. a ring). Wolf et al. also discloses the oxygen concentrations of grown single-crystal Si which is in the range claimed by the applicants. The examiner must infer from this evidence that one of ordinary skill in the art would have found it obvious that Si pure enough for forming semiconductor wafers and devices thereon is pure enough to form a focus ring used in an semiconductor wafer etching chamber. This is so because Ke et al. uses the Si focus ring for holding semiconducting Si wafers (see col. 3 lines 10-20). Additionally, the gettering ability of oxygen concentrations in Cz-Si within the applicant's claimed range were given by Wolf et al. forming the basis of intrinsic gettering (page 59).

The traverse on page 5 of paper #14 is not persuasive in that single crystal Si was known to be obtained with the claimed oxygen concentration by the claimed Czochralski (Cz) method. Col. 6 lines 30-48 of Ke lists the reasons for using Si focus rings for etching Silicon Oxide. Oxygen coming from the Si at the claimed concentrations [10-20 parts per million oxygen (Wolf et al. page 59) or, equivalently by mathematics, 0.001%

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oxygen] is not going to contaminate the SiO₂ (silicon oxide) which is chemically 66% oxygen. The teaching away argument is not even remotely persuasive in this context.

The argument that it is difficult to dope nitrogen into Si without precise control is noted. This is true with any of the dopants described by Wolf as typical for single crystal Si. Nitrogen was a known dopant for Si and had known benefits as per Wolf.

The argument that there is not a teaching that improved mechanical strength increases erosion resistance and therefor the life of the ring. Wolf et al. suggests that the warpage of Si is decreased by nitrogen (page 32) and oxygen. The thermal cycling typical in plasma environments would have lead one of ordinary skill in the material science art to conclude that Si with oxygen and nitrogen would have less warpage during use and thus a longer life on average.

The teaching away argument concerning nitrogen doping of the focus ring is not convincing. Ke states that the Si have extremely low impurity concentrations. The claimed doping concentration are extremely low concentrations

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The cited references combined as noted do indeed at least suggest the claimed invention.

Motivation for including nitrogen in the Si was given above. Warpage resistance for a focus ring contacting other wafers would have been a desirable property to reduce damage to those wafers.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
April 10, 2003


BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
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